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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,122	02/11/2004	Sung-Hwan Byun	SAM-0562	5473
7590	01/25/2005		EXAMINER SARKAR, ASOK K	
Steven M. Mills MILLS & ONELLO LLP Suite 605 Eleven Beacon Street Boston, MA 02108			ART UNIT	PAPER NUMBER
			2829	
DATE MAILED: 01/25/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/776,122

Applicant(s)

BYUN ET AL.

Examiner

Asok K. Sarkar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 2/11/2004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1 – 4, 6 – 8, 10, 12 – 15, 17 – 18 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin, US 2004/0106067.

Regarding claims 1, 2, 12 and 13, Lin teaches a method for manufacturing a semiconductor device by forming a minute pattern comprising:

- forming a photoresist mask layer on a target layer formed on a substrate (see Fig. 2);
- patterning the photoresist mask layer to form a first photoresist mask pattern having a first width larger than a predetermined width (see Fig. 2);
- thermally treating the first photoresist mask pattern to form a second photoresist mask pattern having a second width smaller than the first width (see Fig. 2);
- forming a polymer layer on the second photoresist mask pattern (see Fig. 2);
- reacting the polymer layer with the second photoresist mask pattern to form a third photoresist mask pattern having a third width substantially identical to the predetermined width (see Fig. 2); and

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- etching the target layer using the third photoresist mask pattern as a mask to form a target layer pattern in descriptions of paragraphs 6 and 13 – 20.

Regarding claims 2, 3 and 14, Lin teaches target layer of f insulating layer in paragraph 14 and pattern of holes by etching in paragraph 6.

Regarding claims 4 and 15, Lin teaches thermally treating the first photoresist mask pattern is performed at a temperature of about 140°C to about 180°C in paragraph 17.

Regarding claims 6, 7 and 15, Lin teaches water soluble polymers in paragraph 18 and there are melamine and polyvinyl based polymers that are inherently water soluble.

Regarding claims 8, 10, 18 and 20, Lin teaches heating the second photoresist pattern with the polymer at a temperature lower than the glass transition temperature of the first heating process which is between temperatures of 90 – 150 °C in paragraph 19.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 5 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin, US 2004/0106067.

Lin teaches fine pattern formation for DUV lithography below 100nm and CD shrinkage methods but fails to teach width difference below 100nm.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention that Lin is reducing the width below 100nm since the wavelength limit of the DUV lithography is up to 100nm as taught by him in paragraph 5.

7. Claims 9, 11 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin, US 2004/0106067 in view of Yeo, EP 0825492.

Lin fails to teach prior to reacting with the polymer exposing the second photoresist mask to DUV and remaining polymer layer after reacting with the second photoresist pattern is removed using a deionized water.

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Yeo teaches exposing the photoresist pattern to DUV radiation for the benefit of controlling the thermal flow amount of the resist by the post exposure baking process in column 3, lines 10 – 14.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Lin and expose the photoresist pattern to DUV radiation for the benefit of controlling the thermal flow amount of the resist by the post exposure baking process as taught by Yeo in column 3, lines 10 – 14.

It would have been obvious also to one with ordinary skill in the art at the time of the invention to modify Lin and remove the unreacted polymer using a deionized water rinse since depending on the resist and the width reduction required there will excess polymer that will be left on the resist and need to be removed. Since the polymer is water soluble, therefore it would have been obvious also to one with ordinary skill in the art at the time of the invention to use deionized water since deionized water is standard rinsing medium in the semiconductor industry.

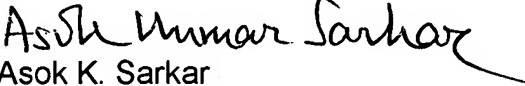
### ***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nestor Ramirez can be reached on 571 272 2034. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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9. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Asok K. Sarkar  
January 21, 2005

Primary Examiner